Welcome to Spring Semester 2016

Math.1330 - PreCalculus

Section 12472 .

Tuesday – Thursday
11:30 – 1:00 pm

Instructor: Dr. Blerina Xhabli

Email: blerina@math.uh.edu

Feel free to email me anytime, make sure you complete
Subject : Math. 1330 – TuTH
Body : Introduce yourself, then write your question

Webpage: math.uh.edu/~blerina

this webpage is very important for our class.

Office: 609 PGH

Important Information: Read the syllabus.

- CourseWare Accounts (fingerprints)

www. casa.uh. edu ← create an account

- go to CASA Center located at Garrison Gym.
- free access for two weeks.

- Textbook ← at the end of two weeks, you need the course access code. ($ 50 bookstore)

It will be available online on your CASA accounts.

- Daily Poppers – Section 12472

Beginning 3rd week of classes, we'll have in-class easy quizzes. You need bubbling forms for these poppers ($ 50 at bookstore).

- Homework (per section) ← EMCF tab

Homework will be assigned according to the sections. Follow the deadlines.

Submit the solutions to casa account under EMCF tab.

- Online Quizzes

Once you complete course policy quiz, all the quizzes will be available to you. Follow the deadlines. Do not leave for the last day. You have 20 times for each!

- 4 Exams and Final Exam

All exams will be taken at CASA center. You have to reserve yourself a seat during exam period. You have two weeks in advance for each.

- Opt-Out option ← at least 80% average.

Once we are done with all assignments (except final), if your class average is $\geq 80.00\%$ then you'll have a chance to opt-out if you are satisfied with your grade!

Grades:

Test 1 - 10%

Tests 2, 3, 4 - 15% each

Final exam - 15%

Homework - 10%

Online Quizzes - 10%

Daily Quizzes (In-class Poppers) - 10%

Note: **The percentage grade on the final exam can be used to replace your lowest test score.**

Course Policy Quiz: ← Take it ASAP!

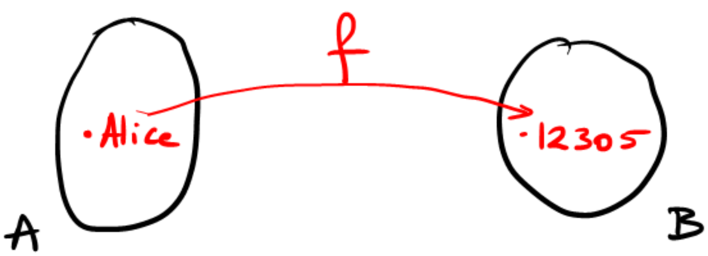
You will need to make a 100 before you can access any exams, quiz, or homework.

Warm-Up: What is a function?

Answer: A function is a special relation between two sets A and B such that for every element x in A, there exists exactly one y in B.

example:

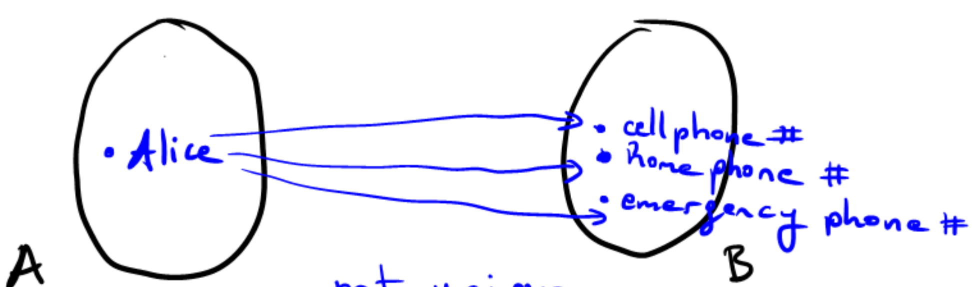
a) All students in this class — Their people soft ID



PSID is unique for each student.

$\Rightarrow$ f is a function.

b) All students in this class — Their phone numbers in the UH system



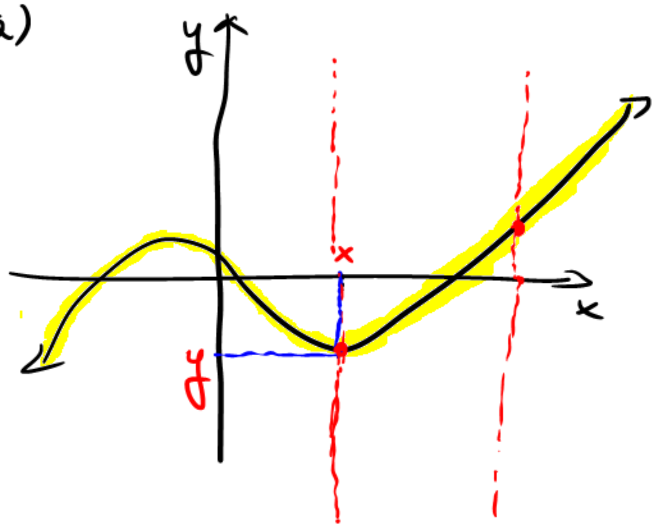
not unique

Every student does have more than one number on file $\Longrightarrow$ not a function!

How can we recognize functions ?

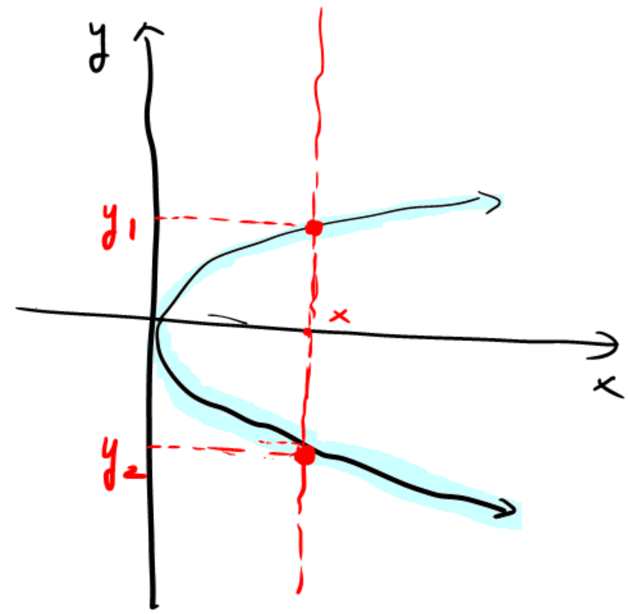
- graphs - Vertical line Test

a)



Yes, it is a function.

b)



No, it is <u>not</u> a function.

- equations ← y should be uniquely represented

a) $y = 2x + 3$

For every input x,
the output y is
defined uniquely.

$\Rightarrow$ Yes, it is a function.

b) $x = y^2 - 1$

For $x = 0$, we get

$0 = y^2 - 1$

$\Rightarrow y^2 = 1 \Rightarrow y = 1$ or -1.

$\Rightarrow$ <u>Not</u> a function.

Math 1330 Section 1.1
An Introduction to Functions

Note: This section covers prerequisite material. I will only solve some of the problems here. The rest will be exercises for you…

Let A and B be two nonempty sets. A function from A to B is a rule of correspondence that assigns to each element in A exactly one element in B. Here A is called the domain of the function and the set B is called the range of the function.

Domain of a Function (-the set of all possible inputs)

To determine the domain of a function, start with all real numbers and then eliminate anything that results in zero denominators or even roots of negative numbers.

ex $f(x)=\frac{1}{x}$, $x \neq 0$ $g(x)=\sqrt{x}$, $x \geq 0$

domain ✓ The domain of any polynomial function is $(-\infty,\infty)$, or all real numbers.

polynomial ⇒ sum of positive integer power of x, $p(x)=3x^3-5x^2+\sqrt{3}x^1-\frac{2}{3}$

domain → The domain of any rational function, where both the numerator and the denominator are polynomials, is all real numbers except the values of x for which the denominator equals 0.

? → $\boxed{\text{denominator} \neq 0}$

domain → The domain of any radical function with even index is the set of real numbers for which the radicand is greater than or equal to 0. The domain of any radical function with odd index is $(-\infty,\infty)$.

? → $\boxed{\text{radicand} \geq 0}$

Example: State the domain of the function. Write your answer using interval notation.

a) $f(x)=\dfrac{x-3}{x+7}$ ⇒ rational ⇒ denominator $\neq 0$

$x+7=0$ ⇒ domain: all x except -7.

$x=-7$

$-\infty$? $+\infty$

-7 0

"-7" not included

$\boxed{\text{Dom } f = (-\infty,-7)\cup(-7,\infty)}$

exercise

b) $g(x)=\dfrac{x^2-5x+4}{x^2-16}$

c) $h(x)=\sqrt{x+4}$

even root ⇒ $x+4 \geq 0$

⇒ $x \geq -4$

$-\infty$ $+\infty$ -4 0

⇒ $\boxed{\text{Domain } h = [-4,\infty)}$

d) $h(x)=\sqrt[3]{x^2-9}$

odd root ⇒ no problem ⇒ $\boxed{\text{Domain} = (-\infty,\infty)}$

e) $f(x)=\dfrac{\sqrt{x-1}}{x-5}$

① As rational fn, $x-5 \neq 0$

$x \neq 5$

② Looking separately, $x-1 \geq 0$ ⇒ $x \geq 1$

Combine both of them!

$x \geq 1$

$x = 5$ not included.

$$\Longrightarrow \quad \boxed{\text{Dom} f = [1, 5) \cup (5, \infty)}$$

1 is included

$x \geq 1$

Note: Review Interval Notation.

b) $g(x) = \dfrac{x^2 - 5x + 4}{x^2 - 16}$

Rational function $\Rightarrow$ denominator $\neq 0$

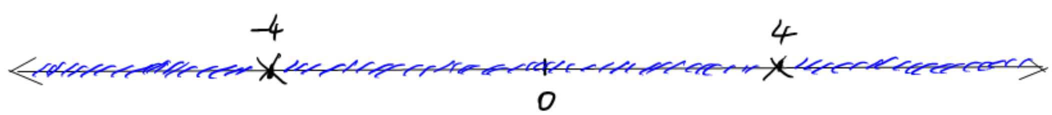
$x^2 - 16 = 0$

$x^2 = 16$

$x = 4, \ x = -4$

$\Longrightarrow \quad x \neq 4$

$x \neq -4$



$$\boxed{\text{Dom } g = (-\infty, -4) \cup (-4, 4) \cup (4, \infty).}$$

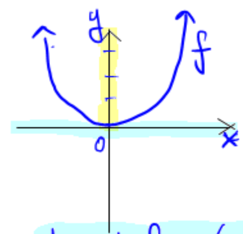
To be continued on Thursday; 1/21.

Range of a Function (the set of all possible outputs) = all possible y-values of the graph.

To determine the range of a function, determine what outputs are possible. This is not always easy. Sometimes it helps to graph the function. The graph tells everything about a function.

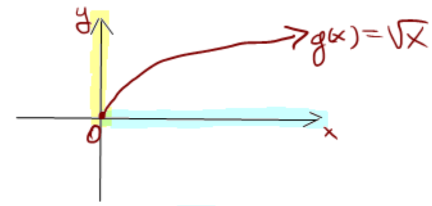
You should know some of these from college algebra. For example:

1. The range of $f(x) = x^2$ is $[0,\infty)$.
2. The range of $g(x) = \sqrt{x}$ is $[0,\infty)$.
3. The range of $h(x) = |x|$ is $[0,\infty)$.



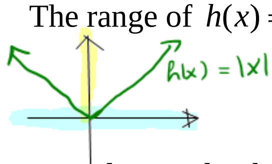
domain $f = (-\infty,\infty)$

range $f = [0,\infty)$



domain $g = [0,\infty)$

range $g = [0,\infty)$



You also need to be able to evaluate a function at a given value of x or at an expression.

EVALUATION: process of substituting the given value of x in the function!

Example: If $g(x) = \dfrac{x}{2x-4}$, find $g(1)$, $g(-5)$, $g(2x-1)$, $g(t+1)$

$g(1) = \dfrac{1}{2\cdot 1 - 4} = \dfrac{1}{-2}$

$g(-5) = \dfrac{-5}{2\cdot(-5)-4} = \dfrac{-5}{-14} = \dfrac{5}{14}$

$g(2x-1) = \dfrac{2x-1}{2(2x-1)-4} = \dfrac{2x-1}{4x-6}$

$g(t+1) = \dfrac{t+1}{2(t+1)-4} = \dfrac{t+1}{2t-2}$

Piecewise Functions

Example: If $f(x) = \begin{cases} 2x+4, & x<-1 \\ x^2+2x, & -1 \le x \le 5 \\ -6x, & x>5 \end{cases}$, find $f(0)$, $f(4)$, $f(5)$, and $f(-3)$.

- $f(0) = 0^2 + 2\cdot 0 = 0$

  Check $-1 \le 0 \le 5$

- $f(4) = 4^2 + 2\cdot 4 = 24$

  Check $-1 \le 4 \le 5$

- $f(5) = 5^2 + 2\cdot 5 = 35$

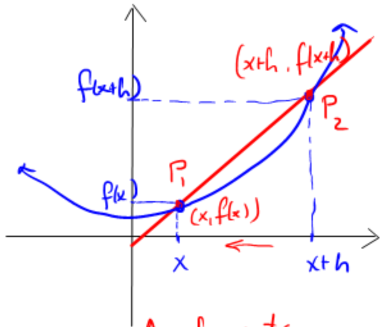
  Check $-1 \le 5 \le 5$

- $f(-3) = 2(-3) + 4 = -2$

  Check $-3 < -1$

Recall: Slope of a line btw two points

$$\Rightarrow m = \frac{y_2 - y_1}{x_2 - x_1} \underset{\text{in our case}}{=} \frac{f(x+h) - f(x)}{(x+h) - x} = \frac{f(x+h) - f(x)}{h}$$



Average Rate of Change (Difference Quotient) (you will need this in Calculus!)

$$\frac{\text{change in } y}{\text{change in } x} = \frac{f(x+h) - f(x)}{(x+h) - x} = \boxed{\frac{f(x+h) - f(x)}{h}} = \text{slope of a secant line on a curve.}$$

As h gets smaller, the secant line becomes a tangent line at x, whose slope = Derivative

CALCULUS

Just calculate

To find a difference quotient, you will compute $\frac{f(x+h) - f(x)}{h}$, assuming that $h \neq 0$. You can do this in three steps:

1. Compute $f(x+h)$.

2. Then compute $f(x+h) - f(x)$.

3. Then compute $\boxed{\frac{f(x+h) - f(x)}{h}}$. Calculate/simplify

3 steps

Example: Find the difference quotient of: $f(x) = x^2 + 2x$

1. $f(x+h) = (x+h)^2 + 2(x+h) = \underbrace{(x+h)(x+h)}_{\text{FOIL}} + 2x + 2h = x^2 + 2xh + h^2 + 2x + 2h$

2. $f(x+h) - f(x) = x^2 + 2xh + h^2 + 2x + 2h - (x^2 + 2x) = \cancel{x^2} + 2xh + h^2 + \cancel{2x} + 2h - \cancel{x^2} - \cancel{2x}$
$= 2xh + h^2 + 2h$

3. $\frac{f(x+h) - f(x)}{h} = \frac{2xh + h^2 + 2h}{h} = \frac{\cancel{h}(2x + h + 2)}{\cancel{h}} = \boxed{2x + h + 2}$

exercise **Example:** Find the difference quotient at $x = 2$ of: $f(x) = \frac{1}{x+1}$

1. $f(x+h) = \frac{1}{(x+h)+1} = \frac{1}{x+h+1}$

Common denominator

2. $f(x+h) - f(x) = \frac{1}{x+h+1} \cdot \frac{x+1}{x+1} - \frac{1}{x+1} \cdot \frac{x+h+1}{x+h+1} = \frac{x+1 - (x+h+1)}{(x+h+1)\cdot(x+1)} = \frac{-h}{(x+1)(x+h+1)}$

3. $\frac{f(x+h) - f(x)}{h} = \frac{\frac{-h}{(x+h+1)(x+1)}}{h} = \frac{-\cancel{h}}{(x+1)(x+h+1)} \cdot \frac{1}{\cancel{h}} = \boxed{\frac{-1}{(x+1)(x+h+1)}}$

difference quotient

Evaluate at $x = 2$ $\Rightarrow \frac{-1}{(2+1)(2+h+1)} = \boxed{\frac{-1}{3(3+h)}}$.